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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Review of Part 15 and other Parts	)	**ET Docket No. 01-278**
of the Commission's Rules	)	**RM-9375**
	)	**RM-10051**

To: The Commission

REPLY COMMENTS OF ARRL, THE NATIONAL ASSOCIATION FOR AMATEUR RADIO

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March 12, 2002

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SUMMARY

ARRL, The National Association for Amateur Radio ("ARRL," also known as the American Radio Relay League, Incorporated), hereby respectfully submits its reply comments in this proceeding. These reply comments address the proposed changes in the Commission's Part 15 rules governing unlicensed radio frequency identification (RFID) systems at 433 MHz.

The large number of comments filed by Amateur Radio operators in this proceeding, all of which reveal extreme concern about this proceeding, should be sufficient to establish that the 425-435 MHz RFID rules proposed are flawed from their inception and should not be adopted under any circumstances. The band 420-450 MHz, and especially the subband 425-435 MHz, is extremely heavily used by radio Amateurs, especially for weak-signal terrestrial SSB, propagation research, wideband video repeater inputs, and other uses. The interference analyses submitted recently by SAVI are flawed in the assumptions made, and in the conclusions reached. ARRL has, and continues, to rebut the compatibility claims made by SAVI. SAVI makes a device which, while it may have some potential commercial value, should be deployed, if at all, in a band in which there is existing accommodation for such devices. Operation of near-continuous duty devices at Section 15.231(a) power levels at 433.92 MHz, and the surrounding band segment, is fundamentally incompatible with incumbent Amateur operation and cannot be permitted.

The few comments in support of the SAVI proposal ring hollow since they do not attempt to justify the use of the band or address the interference that would inevitably result to Amateur stations. Other comments suggest opening the band generally to high power Part 15 devices for nursery monitors or other communications devices. Nothing in any of those few supporting comments justifies the SAVI proposal at all.

It is not only radio Amateurs who would suffer preclusive interference from RFID devices operating in accordance with the Notice parameters. Millions of incumbent, deployed consumer access devices stand to be rendered unreliable, and due to security functions performed, worse than inoperative. While Amateur Radio is generally compatible with these Part 15 consumer devices, it would not be compatible with high-power, continuous duty RFID tags.

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ARRL, The National Association for Amateur Radio ("ARRL," also known as the American Radio Relay League, Incorporated), by counsel and pursuant to Section 1.415 of the Commission's Rules (47 C.F.R. §1.415) hereby respectfully submits its reply comments in the above-captioned proceeding pursuant to the *Notice of Proposed Rule Making and Order* (the "Notice"), FCC 01-290, 66 Fed. Reg. 56793, released October 15, 2001. These reply comments address the proposed changes in the Commission's Part 15 rules governing unlicensed radio frequency identification (RFID) systems at 433 MHz. In reply to comments filed in this proceeding to date, ARRL states as follows:

I. Introduction

1. By far the issue of greatest interest in the comments filed since the release of the Notice in this proceeding is the proposed evisceration of the Section 15.231 rules as they would apply to RFID systems at 425-435 MHz. There were approximately 132 comments filed by Radio Amateurs or Amateur Radio organizations in this proceeding, all of which are opposed to the proposal to allow high-power, continuous-duty RFID tags and interrogators in the weak-

signal portion of the most popular and heavily-occupied UHF Amateur band. Only a very few comments supported the proposal, and the arguments offered therein are, as will be discussed, either insubstantial, or based on factual inaccuracies.

2. It is difficult in a proceeding such as this to propose a constructive solution that would be acceptable to all. There will be severe, harmful interference inevitably created should the proposed rules be enacted as proposed. At the same time, there is apparently no room on the part of the single company interested in manufacturing devices configured as proposed in the Notice, for any compromise. SAVI is apparently disinterested in any accommodation, either by change in the frequency band at issue, or in reduction of the power level or duty cycle of the devices proposed in the Notice. The Amateur Service, as the potential victim of the interference to be created, is asked to accept that interference, which in this case it cannot do. There is fundamental incompatibility between, on the one hand, RFID tags operating on a continuous basis, without geographic limitation whatsoever, at power levels appropriate only for extremely short duration periodic transmissions; and on the other hand, intensive, incumbent, licensed Amateur Radio terrestrial weak signal communications using high gain antennas and extremely sensitive receivers. There are also large numbers of co-channel Amateur Television repeater inputs at 434 MHz in areas immediately proximate to warehouses and dock areas where the SAVI devices may be expected to be used. To argue, as SAVI does, that such uses are compatible in this instance is untrue. ARRL will, nevertheless, attempt to address the issue in terms of its component elements.

3. ARRL has already shown why, from the perspective of the Amateur Service, an incumbent and heavy user of the 420-450 MHz band on a compatible, coordinated basis with

the Federal Government, the band 425-435 MHz is the worst possible choice of frequencies for RFID systems configured as proposed. SAVI's attempts to justify the use of its own product, however, address only the 433.92 MHz center frequency used by its devices as presently configured. This is misleading in the extreme, since the tests SAVI has done have addressed only that one frequency, and not the remainder of the 425-435 MHz band. The Commission should not create Part 15 rules to accommodate a single company's product, or even one type of RF device. Assuming *arguendo*, however, that doing so is somehow justifiable, the comments show that even making the single frequency 433.92 MHz (or the segment 433.05-434.79 MHz)[1] available for these devices would in any case result in extensive interference to incumbent Amateur stations which regularly use that band segment.[2]

4. There is a fundamental flaw in the premise for the Commission's proposal for RFID systems, which is unaddressed in the Notice, and which SAVI has never addressed. The Commission tailored its Part 15 rules at the time of its most recent rewrite of that Rule Part to allow intentional radiators to operate at certain power levels which will not, in general, result in interference to licensed services. This it must do in any case, in order to avoid the statutory requirement to license the operation of RF devices. 47 U.S.C. §301. The general rule (Section 15.209(a) for intentional radiators, including continuous duty devices, operating in the band 216-

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[1] No. S5.280 of the ITU Radio Regulations designates the band 433.05-434.79 MHz (center frequency 433.92 MHz) for ISM applications in certain European countries. This is not an ISM band elsewhere.

[2] Comments of amateur television (ATV) users note that, pursuant to regional band plans, extensive use is made of the 434 MHz segment for ATV repeater inputs. These wideband devices would be interfered with at significant ranges from RFID tags within the passband of these repeater inputs.

930 MHz, is that such devices are limited to radiated field strengths not to exceed 200μV/m measured at 3 meters (employing a CISPR quasi-peak detector). The premise for the special rules (Section 15.231) governing periodic radiators [which permit substantially greater radiated radiated power levels than are permitted by Section 15.209(a) for devices which radiate only for a very short interval followed by a very long silent period], is that devices using those high radiated power levels will not interfere with licensed communications services because, and only because, of the extremely short duty cycle. The Commission's Notice does not suggest that the radiated emission levels permitted by Section 15.209(a) for intentional radiators at, for example, 433.92 MHz were established arbitrarily, or that those levels are unreasonably low relative to continuous-duty intentional radiators at that frequency. There is no quality of either RFID tags or RFID interrogators that would differentiate them from any other intentional radiator in terms of interference potential, if operated according to the proposed, essentially continuous, duty cycle.

5. Therefore, if SAVI or any other manufacturer wishes to operate a continuous duty intentional radiator at 433.92 MHz, it has two choices: it can operate at radiated field strength levels of 200 μV/m measured at 3 meters, or it can utilize substantially higher power and operate according to the periodic rates specified at Section 15.231(a) and (e) of the Rules. It could only do both on an unlicensed basis, however, in bands specifically designated for higher power radiated levels, such as 902-928 MHz or 2400-2483.5 MHz. The proposed elimination of the periodic rate limitations in Section 15.231 constitutes the abandonment of the entire philosophy of regulation underlying the current Part 15 rules governing unlicensed intentional radiators. It is in no sense a "minor" rule change, as SAVI dismissively characterizes the matter.

Furthermore, as discussed more fully in the ARRL's comments filed earlier, this major policy change cannot be effectuated by the Commission because it is *ultra vires* the Commission's statutory authority. Devices operating at the proposed parameters inherently possess an interference potential which makes unlicensed operation impossible. Pursuant to Section 301 of the Communications Act of 1934, such devices must be licensed in order to be operated at all.

II. SAVI Technology, Inc. Comments

6. SAVI suggests that it has "endeavored to clearly describe the changes to Part 15 to appease the Amateur Radio community."[3] In fact, the changes to Part 15 are well-understood by both ARRL and the individual Amateurs who filed comments. It is unnecessary for SAVI to explain the changes proposed. There is no way to "appease" the Amateur Service in this case, unless SAVI utilizes another frequency band other than 420-450 MHz for these devices. SAVI includes the results of what it terms "tests" of its devices at two Amateur stations which purport to establish the absence of interference from the operation of its device to certain amateur equipment. Attached hereto as **Exhibit A** is a technical rebuttal of those test results, prepared by the ARRL laboratory. This establishes that the test assumptions (to the extent the test conditions are disclosed in the brief and incomplete report provided by SAVI) are flawed and the conclusions therefore compromised.

7. As support for its proposal, SAVI cites to comments filed by United Parcel Service and Oracle Corporation and two other individuals. Those comments were filed in support of SAVI's rulemaking Petition. SAVI fails to note, however, that UPS and Oracle are both venture capital investors in SAVI, and the weight to be accorded their comments obviously is tempered

[3] SAVI Comments, at 1.

by their inherent bias. Be that as it may, ARRL does not dispute that package tracking using RFID technology is a beneficial application as a general matter. Such does not, however, justify the requested operating parameters regardless of the interference effects thereof on licensed radio services. As stated previously, there is no importance whatsoever to use of the 433.92 MHz frequency, and certainly not the 425-435 MHz band, relative to RFID technology. SAVI should be instructed to choose another frequency band where its devices are not fundamentally incompatible with a licensed radio service allocation, heavily occupied.

8. SAVI argues that Amateurs "misunderstand" its request. It asserts that, "(d)espite repeated attempts by SAVI to discuss its RFID product, and a variety of tests run in cooperation with the Amateur community", what SAVI describes as its "minor" change continues to be "stubbornly" opposed by this "radio user group". In fact, SAVI has never asked ARRL to participate in interference tests, save for one occasion in which a SAVI consultant contacted the President of ARRL, Mr. Jim Haynie of Dallas, Texas, regarding a test demonstration. Mr. Haynie invited the SAVI consultant to Mr. Haynie's residence, and Amateur Station W5JBP. The SAVI consultant attempted a demonstration of the SAVI device, using as the victim receiver a commercially manufactured portable FM transceiver (which are not typically deployed anywhere in the 425-435 MHz band by radio Amateurs). Mr. Haynie noted that the test was not representative of the interference that would be experienced, and instead utilized as a victim receiver a typical, commercially manufactured amateur SSB receiver in the 425-435 MHz band, at which time severe interference was experienced, and a full-scale meter reading registered on the SSB receiver. SAVI has never reported this incident to the Commission.

9. ARRL and the Amateurs filing comments in this proceeding are well aware of the

nature of SAVI's product, and the proposal contained in the Notice. Amateurs realize that this is hardly a "minor" change. SAVI, having reviewed some of the Amateur comments in the proceeding filed prior to the comment deadline, asserts at page 6 of its comments that "the only new issue raised is about the 'weak signal' service" and the effect that SAVI's system would have on this service. Actually, ARRL comments filed long ago in response to SAVI's original petition addressed the uses made of the 430-435 MHz band, and the fact that what Amateurs do in this segment include regular, active weak-signal terrestrial communications using high-gain antennas aimed at the horizon. There is nothing "new" here, except SAVI's realization of the extremely poor choice of frequency bands. That the Commission did not acknowledge any of ARRL's concerns when, apparently without analysis, it included SAVI's petition with the remainder of the proposals in this proceeding, does not render those concerns "new."

10. SAVI argues that the Amateur community misunderstands the power levels permitted by a combination of Sections 15.231(e) and 15.35(c). It argues that the power levels proposed in the Notice are permitted for periodic radiators now by virtue of the averaging provisions of Section 15.35(c), and that its devices can transmit legally now at up to 110,000 μV/m at 3 meters distance from the antenna. Regardless of the averaging provisions, however, the Section 15.231 rules permit power levels that high only for control devices, and not for continuous duty devices. The power levels for normal periodic radiators other than control devices are limited to lower power, and have a duty cycle not to exceed one second, followed by off-times at least 30 times the on-time. Section 15.231(a) specifically states that continuous transmissions *are not permitted.* Viewed another way, the essentially continuous duty devices proposed in the Notice would normally be limited to 200 μV/m at 3 meters by Section 15.209. For SAVI to be able to

argue that no power increase is sought assumes that the devices would not operate at a greater periodic rate than is currently specified in Section 15.231(e).

11. SAVI again claims at page 8 of its comments that its interrogators are at fixed locations, and the tags only operate when interrogated, so that the devices will be operated in a warehouse or in a commercial or other "controlled" environment. This does not appear to be an accurate assessment, given the comments of UPS and others, but even if it is correct, it does not preclude interference. Amateur Radio stations are regularly located proximate to warehouse or commercial environments such as port facilities. Furthermore, SAVI is not the only manufacturer which would be eligible to develop and market RFID devices at 425-435 MHz, and the proposed rules do not limit the devices to environments that would preclude interference, assuming that such environments exist anywhere.

12. SAVI, at page 9 of its comments, claims that it "carefully chose the 433.92 MHz frequency to ensure the proper operation of its system, to make certain its Federal government and commercial customers could both deploy the system, and to ensure that the costs of the product were economical." Of these three attempted justifications, only the third makes any sense at all. The frequency 433.92 MHz has nothing whatsoever to do with the "proper operation" of the SAVI system. This vague reference from SAVI has been made before, and is not justified by any technical reference in this proceeding that ARRL has been able to find.[4]

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[4] SAVI claims that at 433 MHz, there is 25 dB of loss if a tag on a container is shielded from the interrogator by another container, and that this effect is more pronounced at, for example, 902-928 MHz. While there may indeed be some additional attenuation at the higher frequency band, greater power can be used at 902-928 MHz (See §15.249, which permits field strengths in that band of 50mV/m at 3 meters, using an average detector), thus amply offsetting the slight additional attenuation (which SAVI does not quantify) that might exist from use of the higher band.

There would be no difference in the Federal and commercial deployment of a SAVI device operated at, for example, 902-928 MHz under Part 15 rules, so the 433.92 MHz frequency is not necessary to enable both Government and non-government entities to utilize these devices. In essence, it is exactly what ARRL has noted in this proceeding all along: the frequency was chosen due to the availability of cheap parts for the devices from Europe. The 900 MHz band is not demonstrated by SAVI to be "useless" for package tracking. Quite the opposite is true: the international harmonization efforts of other companies involve 915 MHz in the United States and 868 MHz in Europe. These more forward-looking efforts belie SAVI's unsubstantiated claim.

13. SAVI asserts that it arrived at the 433.92 MHz frequency after an "exhaustive review of international allocations," and discovered that the frequency is available domestically, and in Europe and Asia. As ARRL demonstrated long ago in this proceeding, that is incorrect. The device as proposed cannot be operated in the United States under current rules, and in numerous countries in Europe and Asia, it cannot be operated at all.[5] It is not correct, *contra* SAVI's

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[5] As ARRL noted in reply comments in response to the SAVI petition filed March 16, 2001:

> Even a casual review of 47 C.F.R. §2.106, the Table of Frequency Allocations, reveals that in ITU Region 1, the band 430-440 MHz is allocated on a co-primary basis to the Amateur Service and the Radiolocation Service, and in Regions 2 and 3, to the Radiolocation Service on a primary basis and the Amateur Service on a secondary basis. Listed footnotes for the Region 1 allocation show that there are numerous countries which use the band for fixed, mobile, and aeronautical radionavigation (radio altimeters). The same is true in Regions 2 and 3, and in certain Central and South American countries, the band 430-440 MHz is allocated to the Amateur Service on a primary basis (S5-278). In Mexico, it is allocated to the land mobile service, subject to certain agreements (S5-279). In India, the segment 433.75-434.25 MHz is allocated to the Space Operation Service (Earth-to-space) on a primary basis. In the United States, in coastal areas, both pulse-ranging and spread-spectrum radiolocation systems are authorized

assertion at page 10 of its comments, that the frequency 433.92 MHz is allocated "internationally...for use on an unlicensed basis...without the strict limitations found domestically." As noted in ARRL's comments in this proceeding, the regulatory trend, as illustrated by recent regulatory changes in the United Kingdom, is to limit, rather than expand, duty cycles in this band for low power devices.

14. SAVI's comments next claim that ARRL's interference studies were incorrect, and that its devices will not cause interference to co-channel Amateur operation. This has been addressed exhaustively in *ex parte* submissions (See Exhibits A and B, attached hereto). In short, it is SAVI, and not ARRL, which is mistaken in its technical analysis. The SAVI errors are due in part to SAVI's misunderstanding of the uses made by Amateurs of the 425-435 MHz band. For example, at pages 11 and 12 of its comments, SAVI states that its devices use FSK modulation, and that, because "Amateurs in the 420-450 MHz band use FM modulation", the SAVI signals would not capture the FM discriminator of an Amateur receiver during an Amateur transmission.[6] There are many types of modulation used in this band by Amateurs, and FM voice is only one. The main type of emission is SSB voice in the 432-433 MHz band for terrestrial point to point communications, as ARRL has repeatedly explained. FM voice communications, other than through fixed repeater auxiliary links, are not typically conducted in the segment at issue. The basis for SAVI's calculations, therefore, is a mistaken assumption.

(US217)...[T]he band 433.05-434.79 MHz (center frequency 433.92 MHz) is available for ISM uses in Germany, Austria, Bosnia/Herzegovina, Croatia, Macedonia, Liechtenstein, Portugal, Slovenia, Switzerland and Yugoslavia (S5-280). This hardly constitutes a "worldwide network" and the entire proposition of SAVI's supporters is flawed from its inception.

[6] This is puzzling, inasmuch as FSK is FM modulation.

As well, the test allegedly conducted with an Amateur Earth-moon-Earth station in Texas was conducted in the near field of the antenna, and according to parameters which would tend to minimize the interference effects of the test. A critique of this test is discussed in **Exhibit A** hereto. Finally, at page 13 of its comments, SAVI claims that it "performed extensive research" into the use of the 420-450 MHz band before selecting the 433.92 MHz frequency. It looked at the "ARRL licensed (sic) repeaters"[7] and noted that only a small number operated at this frequency, used for auxiliary and repeater links, leading SAVI to determine that it was the "most appropriate frequency for use." In fact, it is difficult to envision a worse choice of frequency. SAVI cannot honestly make the representation to the Commission that it does at page 14 of its Comments, that the "operating frequency and bandwidth of the system were carefully selected to mitigate any effects that could potentially arise with respect to the licensed users of the 425-435 MHz band." The only way to mitigate the interference in this case would be for SAVI to select another band and abandon its plan for high-power, high-duty-cycle operation at 425-435 MHz.

III. Other Comments In Support of RFID Systems at 425-435 MHz.

15. Some other comments supported the 425-435 MHz RFID provisions proposed in the Notice, but none provided any justification for such. Others were based on mistakes of fact. For

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[7] ARRL does not license repeaters, nor does it coordinate them. That is done locally and regionally. SAVI must be referring to an examination of the ARRL Repeater Directory, which lists only a few of the many auxiliary links. Repeater operation is not conducted in the 425-435 MHz band, and any review of the ARRL Repeater Directory would have revealed the fact that the national band plan for 420-450 MHz does not include FM voice operation in the 425-435 MHz segment. It would also have revealed that most repeater trustees do not disclose the frequencies for control and auxiliary links; that fact is carefully noted in the Repeater Directory. Therefore, the contents of the ARRL Repeater Directory in this instance is irrelevant to SAVI's frequency choice, save for ascertainment of the band plan, which SAVI clearly did not do.

example, Linear Corporation stated, at page 4 of its comments, that it supports "harmonization of rules (relative to RFID systems) between Europe and the United States." The "increase in signal levels" (sic), says Linear, appear to have little chance of causing harmful interference. The reader is not informed how Linear came to that conclusion. If Linear was interested in harmonization of RFID systems between Europe and the United States, it would be supporting deployment of either 13 MHz or 868 MHz devices, not 433.92 MHz devices. Linear states that "the rules reflect the common usage in Europe at approximately a 10 mW average ERP power level." However, nothing is stated about the duty cycle of such devices. However, the reference to "only at 10 mW signal level" is misleading: that power level is, as ARRL has shown, substantial enough to cause interference to Amateur stations at distances in excess of 1 kilometer. None of the conclusions in the Linear comments is supported by any technical showing.

16. The comments of Motorola, Cubic Corporation, HID Corporation, the Consumer Electronics Association, and the Telecommunications Industry Association support the NCITS B10 petition, RM 9375, relating to the 13 MHz RFID systems, but make no reference to the SAVI proposal. Though the comments of DataBrokers, Inc. state that the company supports both the 13 and 433 MHz proposals in the Notice, the substance of their comments relate only to the 13 MHz devices, and state that "we are convinced that 13.56 MHz frequency (sic) is our best option." Similarly, the comments of Texas instruments state support for regulations relative to both bands, but the only discussion in the comments relates to 13.56 MHz devices.

17. In a third category are the comments of Mattel, Interlogix, and Johnson Controls, Inc., which suggest in general that the proposed rules are too restrictive, in that they are limited either in power level permitted or in the purpose of the device. Mattel suggests that the

Commission should permit devices other than RFID systems as well, including audio nursery monitors, that need relatively continuous transmission capability and would benefit from "harmonization with European standards at 433.92 MHz." That this would be a disaster from an interference perspective, both to and from Amateur Radio, is so obvious that further discussion is unnecessary. However, it also illustrates how arbitrary it would be for the Commission to permit RFID tags to operate at continuous duty cycles in the 425-435 MHz band and to create a rule section only for those devices. The entire plan for the Part 15 rewrite in 1989 was to adopt rules that were *not* device-specific, and yet the instant proceeding attempts to do exactly that.

18. Johnson Controls, like Mattel, believes that the category of devices which should be permitted to operate at high radiated field strengths and high duty cycles at 433 MHz should not be limited to RFID devices. It suggests at page 6 of its comments that the new proposed rule Section 15.240 should be broadened to permit any "exchange between sources," at least one of which is fixed. That broad a definition would include virtually any use, and the proposal, like that of Mattel, reflects a distressing lack of understanding of the proper scope of unlicensed intentional radiators. Finally, Interlogix suggests, at page 6 of its comments, that the Commission's Notice proposes to "extend operating time" for RFID tags, but with power levels identical to Section 15.231(a). Instead, Interlogix argues, the power level should be revised upward, to better "harmonize" its regulations with those of the "ITU." Even a 10 dB increase, it says, over the Section 15.231(a) regulations would help harmonize a band that has created "endless difficulties" for control and security alarm manufacturers on the world market." Presumably, the change sought by Interlogix would allow them to market security alarm devices

at 425-435 MHz in the United States. The interference caused to and from Amateur stations by residential security alarms in this band would be severe, and the incompatibility is obvious.

IV. Part 15 Devices Stand to Suffer Interference from RFID Systems at 425-435 MHz

19. There was one noteworthy comment filed by a non-Amateur entity. The Chamberlain Group, Inc. is a manufacturer of access and convenience products for homes and businesses worldwide. It has products deployed in more than 25 million homes and businesses in the United States, including access door and gate products such as garage door openers and other security devices, at 433 MHz in accordance with existing Part 15 regulations. Chamberlain is concerned about interference to its products from RFID devices operating at near-continuous duty at high power levels. Chamberlain's products, because they are compliant with existing Part 15 regulations,[8] do not typically interact with Amateur operation in the 420-450 MHz band. Like the Amateur Service, however, Chamberlain finds that SAVI's assurances about non-interference with incumbent uses near 433 MHz ring hollow indeed:

> Chamberlain has serious concerns about the impact of these proposed modifications to the part 15 rules on commercial and residential electronic access devices already in operation. In its Petition, SAVI lengthily discussed several RFID applications that reflect operation in commercial areas (footnote omitted)

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[8] Chamberlain states, at page 2 of its comments, that:

> "Chamberlain and others have long used 433 MHz for their products and have been encouraged to do so by longstanding Commission rules that strictly limit the duty cycle of devices likely to interfere and require an "off" period that allows reliable functioning of entrance and access devices operated in close proximity. SAVI has now targeted that precise frequency for deployment of a technology that will use a two-minute duty cycle with a 10 second off-period, a cycle that practically equates to continuous usage. Moreover, RFID systems typically use multiple radiators, mobile but concentrated at a single location when activated, and operate in the very commercial areas where interference to critical access systems is most likely to occur...

> while it elsewhere dismissed concerns of Amateur Radio operators because its 'RFID systems typically operate in commercial areas.' (footnote omitted)...It is not difficult to imagine deployment extending to residential areas, and the SAVI petition fails to address the complications that would arise when commercial users are located in or next to residential areas. Trucks and other vehicles equipped with RFIDs would affect such areas as they drive through neighborhoods to deliver products to homes, and, given the mobile nature of RFIDs, the timing and duration of the interference caused would be unpredictable and the particular interference source extremely difficult to detect. Additionally, any commercial users that are located on the borders of residential neighborhoods would create significant risks of interference. Indeed, some likely users of these RFIDs, such as UPS distribution centers, United States Post Offices, and others, would be located *in* residential areas. In metropolitan areas, where commercial and residential users are often intermixed, the likelihood of RFID interference only would increase.
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> *Chamberlain Comments, at 4-5.*

20. Chamberlain notes that when RFID interference occurs at 433 MHz, it would be almost continuous, and would disrupt operation of devices operating under the present Section 15.231(a), by creating incompatibility of extensive duration when "super-RFIDs" are polled serially. Companies that rely on Part 15 devices to access warehouses and storage facilities and homeowners who open their garage doors with Part 15 devices would be denied access without any understanding of the malfunction or how to predict it or remedy it. ARRL is in complete agreement with Chamberlain in this respect. It is important to note that this is not a matter of fundamental incompatibility between Amateur Radio operation and Part 15 operation. Indeed, radio Amateurs regularly operate in bands in which certain types of Part 15 devices operate. However, in this instance, there is, as Chamberlain notes, a "*fundamental incompatibility*" between the SAVI "super-RFIDs" and other periodic radiators operating in accordance with Section 15.231(a) or 15.231(e) of the Rules as they now read. That same incompatibility exists between Amateur Radio and the super-RFIDs in this instance.

VII. Conclusions

26. The large number of comments filed by Amateur Radio operators in this proceeding, all of which reveal extreme concern about this proceeding should be sufficient to establish that the 425-435 MHz RFID rules proposed are flawed from their inception and should not be adopted under any circumstances. The band 420-450 MHz, and especially the subband 425-435 MHz, is extremely heavily used by radio Amateurs, especially for weak-signal terrestrial SSB, propagation research, wideband video repeater inputs, and other uses. The interference analyses submitted recently by SAVI are flawed in the assumptions made, and in the conclusions reached. ARRL has, and continues, to rebut the compatibility claims made by SAVI. SAVI makes a device which, while it may have some potential commercial value, should be deployed, if at all, in a band in which there is existing accommodation for such devices. Operation of near-continuous duty devices at Section 15.231(a) power levels at 433.92 MHz, and the surrounding band segment, is fundamentally incompatible with incumbent Amateur operation and cannot be permitted.

27. The very few comments in support of the SAVI proposal ring hollow indeed, since they do not attempt to justify the use of the band or address the interference that would inevitably result to Amateur stations. Other comments suggest opening the band generally to high power Part 15 devices for nursery monitors or other communications devices. Nothing in any of those few supporting comments justifies the SAVI proposal at all.

28. As is revealed by the comments of The Chamberlain Group, it is not only radio Amateurs who would suffer preclusive interference from RFID devices operating in accordance with the Notice parameters. Millions of incumbent, deployed consumer access devices stand to

be rendered unreliable, and due to security functions performed, worse than inoperative. While Amateur Radio is generally compatible with these Part 15 consumer devices, it would not be compatible with high-power, continuous duty RFID tags. As was stated by Cubic Corporation, at page 4 of its comments:

> Cubic Corporation recommends that the FCC allow incremental changes to the regulations if they are needed and substantiated, but not arbitrarily desired by manufacturers seeking dominance of their products. The FCC regulations have been in force for a long time and telecommunication technology is rapidly increasing that can adhere to the regulations. It will continue to improve and therefore the existing regulations should not be abandoned without adequate justification and analysis.

While Cubic made this reference relative to proposed changes for RFID devices at 13 MHz, the concern applies with equal urgency to the 425-435 MHz band as well.

Therefore, the foregoing considered, ARRL, the National Association for Amateur Radio, again respectfully requests that the Commission not adopt the proposed rules regarding RFID

systems at 425-435 MHz, but rather terminate this portion of the docket proceeding without action.

Respectfully submitted,

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March 12, 2002

EXHIBIT A

ET DOCKET No. 01-278
ARRL Ex Parte Presentation[1]
to the Office of Engineering and Technology
Federal Communications Commission
February 26, 2002

Executive Summary:

In its February 7, 2002, Ex Parte presentation to the Office of Engineering and Technology related to ET Docket 01-278, "Review of Part 15 and Other Parts of the Commission's Rules", Savi Technologies presented summary information of two incomplete and inconclusive field studies. From the results that Savi described, SAVI cannot have used transmissions that simulate the *proposed* new regulations. They may have used interrogators and tags that meet the current FCC regulations for periodic radiators, certainly not a fair comparison. SAVI used non-standard test methods, lacking substantive measurements. The signal levels SAVI suggests are strong enough to cause harmful interference to amateur operation.

SAVI's threshold criteria for interference is a breaking squelch. It concludes that signals in excess of –103 dBW at the input terminals of amateur receivers will not break the squelch of amateur receivers tested. The premise that –103 dBW signals will not be heard by nearby receivers is simply not true.

The proposed rules encompass 425-435 MHz, a frequency range that includes amateur uses significantly more varied than FM and repeater link operation. SAVI's contention that its signals on 433.92 MHz will not cause interference elsewhere in the band is inaccurate and irrelevant; under the proposed rules changes, RFID signals can *appear* "elsewhere in the band," so the on-channel levels are what are important.

Received Signal Level (RSL):

In appendix E of its Ex Parte presentation, SAVI stated:

"The desired RSL is in the range of –89 dBW to –99.4 dBW for antenna heights of 20 to 200 feet."

These received signal levels (RSL) are what SAVI is claiming represent typical amateur operation. The source of these levels is undetermined. As shown in the reference data included in ARRL's January 14, 2002 Ex Parte presentation, the minimum RSLs for various types of amateur operation, including FM voice, are *significantly* below the –89 dBW to –99.4 dBW cited by SAVI. As just one example, on page 5 of its earlier Ex Parte summary, ARRL demonstrated that FM voice desired signals can be as low as –150 dBW for a 12-dB SINAD signal. Corrected for the stipulated 5-dBi antenna gain, this is an RSL of –145 dBW to an isotropic receiving antenna.

A desired signal level of –89 dBW would have a noise margin of approximately 50 dB more than the signals that Amateur operators often use. Although certainly some signals in the Amateur Service could be at this exceptionally strong level, due to close proximity of an amateur receiver to another amateur station, this is the exception, rather than the rule. To the contrary, at VHF and above, an "S9" (extremely strong) signal is often taken to be 50 microvolts into 50 ohms, a level of –103 dBW. In some standards or recommendations, the IARU Region 1 recommendation for S units, for example, S9 on VHF and above is assumed to be –123

[1] Presentation by ARRL President Jim Haynie and General Counsel Christopher Imlay. The calculations in this study were prepared by Laboratory Supervisor Ed Hare and Senior Engineer Zack Lau.

dBW. With this standard, the levels SAVI claim as "typical" are 34 dB higher than the levels the IARU cites for an S9 meter reading. The IARU Recommendation specifies as follows:

> *IARU Region 1 Technical Recommendation R.1*
> *BRIGHTON 1981, TORREMOLINOS 1990*
> ***STANDARDISATION OF S-METER READINGS***
>
> *1. One S-unit corresponds to a signal level difference of 6 dB,*
>
> *2. On the bands below 30 MHz a meter deviation of S-9 corresponds to an available power of -73 dBm from a continuous wave signal generator connected to the receiver input terminals,*
>
> *3. On the bands above 144 MHz this available power shall be -93 dBm,*
>
> *4. The metering system shall be based on quasi-peak detection with an attack time of 10 msec ± 2 msec and a decay time constant of at least 500 msec.*
>
> Note added by ARRL: -73 dBm = -103 dBW and –93 dBm = -123 dBW.

ARRL also questions how the cited RSLs can vary with antenna height. First, it is unclear why the necessary power to the receiver is dependent on antenna height. Certainly SAVI cannot mean that an antenna at 20 feet elevation will receive a signal level of –89 dBW while an antenna at 200 feet elevation will reduce the signal level at the receiver to –99.4 dBW. In general, raising an antenna will result in a stronger signal being received from a distant source, so, levels notwithstanding, this statement is inaccurate.

Carrier/Noise+Interference [C/(N+I)]:

In Appendix E, SAVI cited some figures for carrier/(noise+interference) [C/(N+I)]. ARRL cannot determine how SAVI arrived at these figures. They are not derived from the minimum signal levels provided by ARRL. SAVI claims that at 100 meter separation, (the desired operating range), the [C/(N+I)] level would be 23.5 dB from a SAVI interrogator. The RFID signals do not stop at 100 meters. Although this may be the range that SAVI expects from a 3.6 milliwatt device, a signal at that power level can be used to communicate over a much greater range.

Figure 5 from ARRL's earlier Ex Parte showed a comparison between the desired minimal FM voice signal in the Amateur Service of –150 dBW and the calculated RFID signal level. Here is the corrected data from Figure 5, designated as Figure 1 in this document.

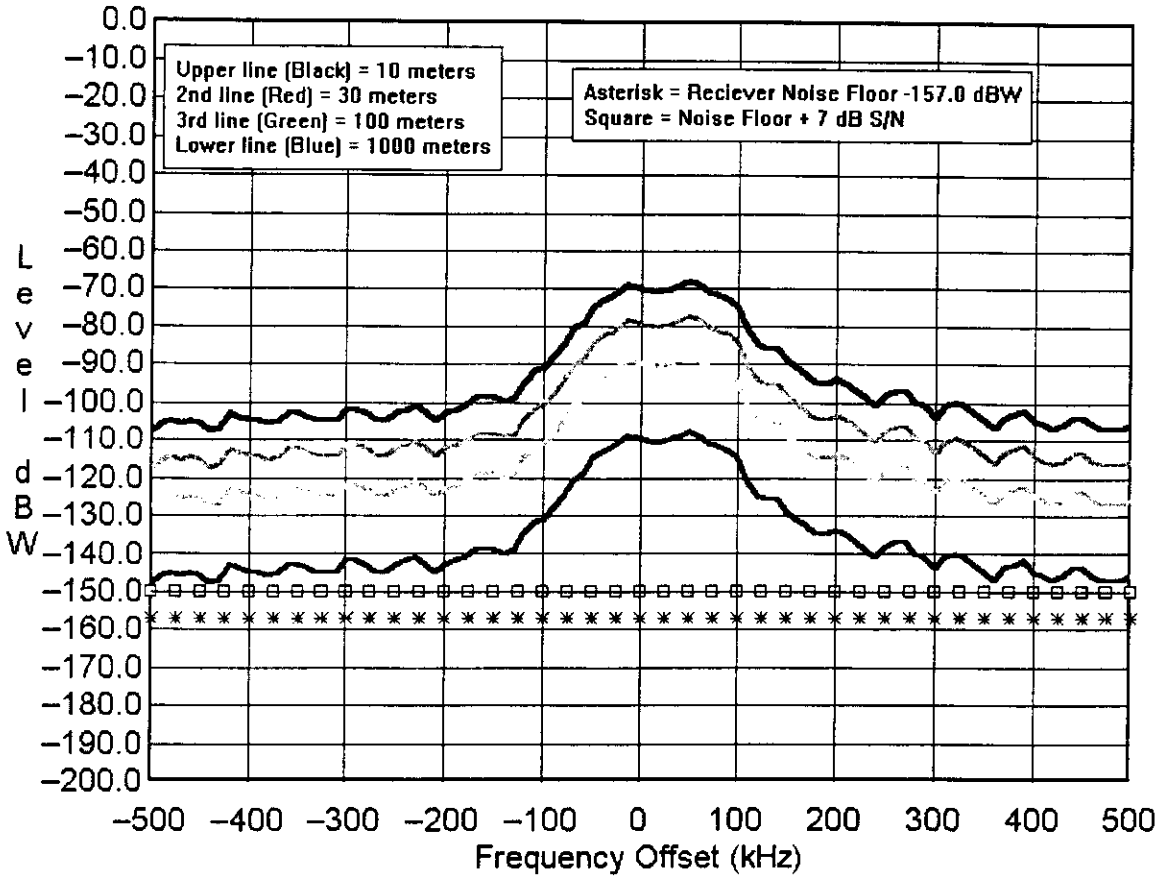

Figure 1. These data show the expected RFID system levels from the typical RFID transmitter generating 110,000 μV/m at 3 meters. The amateur station is an FM receiving station using a 5-dBi gain antenna. The antenna is located at a distance of 10 meters, 30 meters, 100 meters and 1000 meters from the point at which the field is 110,000 μV/m. The predicted levels from the RFID transmitter have been adjusted downward by 3 dB to account for the receiving system bandwidth of 15 kHz. This amateur station typically has –157 dBW of receiver sensitivity and a signal margin of approximately 7 dB for minimal communication. Figure 2 represents measurements made in the ARRL Lab. The receiver tested was an Alinco model DR-605.

FM Voice is an Inappropriate Standard for Determining Interference Potential:

The above analysis assumes that the victim receiver uses a 15K0F3E (FM Voice) emission. SAVI chose this because it represents the "best case" for their position. Other modulation modes are much worse cases than is FM voice. SAVI admits that FM is the mode with the most tolerance for noise and interference. However, the inherent limiting and noise reduction in most FM receiver circuits is not enough to overcome a noise level that is 61 dB greater than the desired signals.

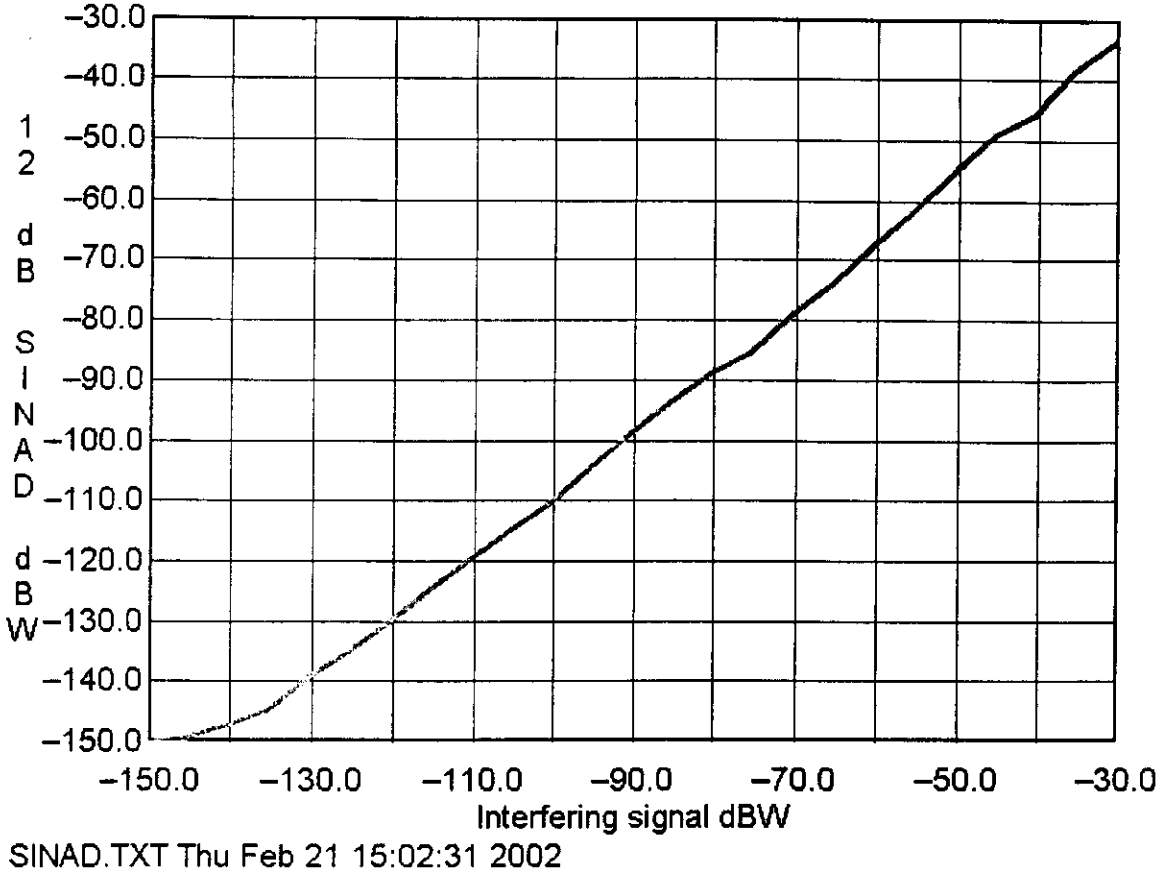

Figure 2: Plot of level of desired signal required to obtain a 12-dB SINAD on a current amateur FM transceiver in the presence of specific levels of 100-kHz-wide FM digital signals. The modulation was a pseudo-random digital stream at 9600 bits/s, with the deviation adjusted to give a –3 dB signal bandwidth of approximately 100 kHz. This is intended to simulate the spectral mask that SAVI presented as typical of its current products. The receiver employed for this test was tuned to the 70 cm amateur band. It has a receiver sensitivity of approximately –152 dBW for 12 dB SINAD and a bandwidth of approximately 15 kHz.

The graph shows about 10 dB of difference between the level of undesired signal and the desired signal. The bandwidth of the undesired signal is 100 kHz while the receiver bandwidth is 15 kHz, explaining 8.2 dB of the difference. The remainder is probably due to the some amount of FM limiting of the noiselike undesired signal. At 12 dB SINAD, there is not much scope for the limiter to work, but some limiting may occur.

SAVI claims that at 100 meters separation, amateur signals will be 23 dB higher than the proposed RFID signal. This is incorrect. To obtain this figure, SAVI significantly overestimated the desired amateur signal and made an error in significantly under-calculating that the RFID signal at 100 meters would be at a level of –122.5 dBW. Even in the FM case, had SAVI used the correct calculations to determine the proposed RFID signal level at 100 meters of –89 dBW and used the amateur FM signal level of –150 dBW the resultant [C(N+I)] would be negative. The undesired signal level is 61 dB higher than the desired signal. This is the level shown in Figure 1 of this document. When other operating modes are evaluated, the [C/(N+I)] becomes increasingly negative in some cases.

EME Weak Signal Report

SAVI presented information about field tests that it had done at Amateur Station K5GW, an Earth-Moon-Earth (EME) amateur operator whose station is at the upper end of performance. In this study, SAVI reports that that a 50 microvolt signal (50 ohms, S9, -103 dBW) was received when a SAVI interrogator and Tag were placed 30 meters from the EME antenna. This is somewhat below the level shown in Figure 13 of the revised ARRL Ex Parte presentation, but the emission levels of the test signals SAVI used, assuming they meet the present rules, are about 8 dB below the levels proposed in the NPRM. A test distance of 30 meters is *well* within the near-field region of that array, so the amount of gain realized to a point that close will be less than what the array achieves in the far field. ARRL does not have specific information about the Yagi spacing of the 64 10-element Yagis used at K5GW, but if they are spaced 1 wavelength apart, a reasonable estimate, the near-field region of this antenna extends to about 90 meters from the center of the array.

Even so, ARRL would expect to see a higher signal level than this, under the test conditions described. If the Savi transmitter were operating at the –24.4 dBW that the rules change would allow for a 0 dBi gain antenna, the path loss over 30 meters to the EME array would be 78.6 dB. The formula for path loss:

$$FSL_{db} = -27.55 + 20\log(D_{meters}) + 20\log(F_{MHz}) \qquad \text{Equation 1.0}$$

predicts that the path loss at 433.92 MHz over a distance of 30 meters should be 54.74 dB. This would mean that if the EME array were achieving full gain over that distance (not likely), the received signal is calculated to be at a level of –79.14 dBW. Of note, this is 20 dB lower than the calculated level of –59.14 dBW at 3 meters separation, again showing good self-consistency to the ARRL data in Figure 1 and Figure 2 of received levels vs distance.

It is unclear how SAVI can contend that a received signal level of –103 dBW will not cause interference to the Amateur Radio Service. For the EME station tested, the received signal level of –103 dBW is significant, considering that under the proposed rules, this signal *could* be present anywhere between 425-435 MHz. This aspect of SAVI's test clearly shows an interference potential from the proposed rules change.

FM Receive Tests at W5OLY:

SAVI also described field testing done at amateur station W5OLY. Like the tests done at K5GW, the results of these tests are lacking in technical data. Again, the test signal used was *not* at the level or duration of the signals being proposed under the NPRM. The peak power is at least 8 dB lower and the duration of transmission is much less. SAVI's own calculations indicate that at a point 3 meters from an RFID device creating a peak field of 110,000 microvolts/meter, the expected signal received on an antenna with 0 dBi gain will be approximately –59 dBW. It is inconceivable that a signal of –59 dBW would not cause harmful interference to amateur communication on the RFID operating frequency. SAVI is correct that if a desired amateur signal level is somewhat above the level of the interfering signal, the FM limiting and capture effect might allow the FM receiver to hear the desired signal with relatively little noise. However, this premise becomes involved if the desired signal is at a level lower than the interfering signal. In almost all cases, especially with handheld FM receivers, such as the one SAVI used for this test, desired signals will be considerably below –59 dBW. From ARRL's reference-circuit data, the desired signal level in an FM voice circuit can be as low as –150 dBW, approximately 90 dB lower than the level SAVI claims as an interference threshold.

EXHIBIT B

ET DOCKET NO. 01-278
ARRL Ex Parte Presentation[1]
to the Office of Engineering and Technology
Federal Communications Commission
February 26, 2002

Executive Summary:

On February 7, 2002, Savi Technologies made several Ex Parte presentations to the FCC Office of Engineering and Technology related to ET Docket 01-278, "Review of Part 15 and Other Parts of the Commission's Rules." ARRL, the National Association for Amateur Radio has analyzed the summaries of these presentations. In these summaries, Savi covered two major points. The first responded to ARRL's Ex Parte presentation of January 14, 2002. Savi claims that ARRL's data and conclusions were incorrect by 30 dB. This conclusion is in error. ARRL is unable to determine how Savi arrived at some of the numbers it presented to the FCC to support this conclusion. ARRL notes that the calculations SAVI supplied are not self-consistent. The ARRL data for free-space propagation and signal levels are correct.

Throughout the course of this proceeding, Savi has made a number of technical claims, all suggesting that the signal levels from a near-continuous transmission of 110,000 microvolts/meter (peak) will not cause harmful interference to the Amateur Radio Service. If these claims are based on the calculation that SAVI used in its Ex Parte presentation, those claims are also in error. If SAVI's assumptions about the amount of power that will be received by nearby receivers (including their tag receivers) are inaccurate by 30 dB, their analysis is incorrect.

Savi's Analysis of ARRL Ex Parte Presentation:

Interference Analysis:

Quotes from the SAVI Ex Parte presentation are in italics. In its presentation analyzing ARRL's Ex Parte presentation and data, SAVI makes the following claim:

"The study is not an interference analysis in that it does not analyze the effect of an undesired received signal level on the desired signal level."

The ARRL presentation included detailed reference-circuit information about the operating parameters of various types of operation in the Amateur Radio Service and plots that showed the levels in these reference circuits against the spectral mask that SAVI offered as being representative of typical operation. It is clear that the effect of undesired signals that are several tens of dB greater than the desired amateur signal will have a harmful effect.

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[1] Presentation by ARRL President Jim Haynie and General Counsel Christopher Imlay. The calculations in this study were prepared by Laboratory Supervisor Ed Hare and Senior Engineer Zack Lau.

Peak-vs-Non-Peak Representation:

SAVI states:

- *"The signal levels from the undesired sources are incorrectly identified. The corrected field intensity levels at the distance of 3 meters are as follows:*
  Interrogator 110,000 microvolts/meter peak
  Tag 43,989 microvolts/meter peak

In its presentation, ARRL chose to simply compare the effect of a 110,000 microvolt/meter field against the reference-circuit data. Although an analysis of peak vs quasi-peak vs average power, vs the PEP ratings of most amateur communication could be done, the end results would, in almost all cases, be within a few dB of the results ARRL has presented. The proposed rules would allow near-continuous transmissions, so the results as presented by ARRL provide the easiest starting point from which corrections to actual signals could be made, should the Commission choose to incorporate those corrections and conditions into the rules. In any event, with undesired signals 100 dB or more above the desired signals in some cases, differences of a few dB do not change the conclusions drawn by ARRL.

It is appropriate to use the peak level of 110,000 microvolts/meter at 3 meters in analyzing the effect of such strong signals on weaker amateur communication. Most receivers in use in the Amateur Radio Service utilize automatic gain control (AGC). The levels of signals in the proposed rules are more than enough to cause the AGC circuits to function. Many, if not most, AGC circuits respond to peak signal levels, and thus the effect on amateur radio would, in most cases, be more related to the peak than the average signals. Other types of amateur communication, such as television or digital communications, would be impacted by the peak levels of the transmitter employed. The transmission times involved are long enough to interfere with video transmissions or with large numbers of bits in a data stream.

To be complete, ARRL included the curves for 11,000 microvolts/meter (SAVI's proposed average emission level) to demonstrate that even if some amateur receiving equipment and operation responds only to the average levels, the effect of these strong signals would be strong enough to cause harmful interference.

Although ARRL appreciates the information that SAVI provided about the peak levels expected from their tag devices, ARRL analyzed the signal levels, conditions and frequencies being proposed in the rules, not the single example offered by the system that SAVI seeks to deploy at this time. ARRL did not tailor its presentation nor its Comments to the SAVI systems, which are not relevant to the notice proposal. Rather, it is only relevant to assume levels permitted by the proposed rules.

ARRL Data are Not in Error by 30 dB:

SAVI states:

- *"The ARRL curves for signal strength at various distances also appear to be in error by 30 dB. The vertical axes of the figures are labeled as dBW. Either the label is wrong or the data is incorrect. DBm vs dBW?*

- *" The correct signal levels at 3 meters when converted to dBm is as follows where, P (dBM) = -77 + 20 log E (in microvolts) – 20 log F (MHz).*
  Interrogator -28.17 dBm or –58.17 dBW
  Tag -36.13 dBm or –66.13 dBW

- *" The undesired received signal levels (Interrogator or tag soured) at 1 Km and 0.1Km is as follows*
  Interrogator -142.57 dBW and -122.57 dBW
  Tag -150.53 dBW and -130.53 dBW

The data in the ARRL curves are not in error by 30 dB. ARRL cannot determine what assumptions SAVI applied in order to reach its conclusion, but the curves shown by ARRL are very clearly identified as being free space curves. The mathematics ARRL used to generate these curves is correct and the results follow theory correctly. SAVI reasonably correctly determined that the received signal level (isotropic receiver) at 3 meters would be –28.17 dBm (minor differences notwithstanding).

But the figure SAVI provided for 0.1 km is not correct. The correct value for isotropic antennas is determined by the approximate formula SAVI used in their presentation, adjusted to give results in dBW and with the addition of a 20log(distance ratio) function (the –107 dB is rounded off in this formula):

$$P_{dBW} = -107 + 20\log(E_{microvolts\ /\ meter}) - 20\log(F_{MHz}) - 20\log(D_{meters_{actual}} / D_{meters_{reference}}) \qquad \text{Equation 1.0}$$

For 3 meters, where the field is presumed to be 110,000 microvolts/meter, this is approximately what SAVI calculated :

$$P_{dBW} = -107 + 20\log(110{,}000) - 20\log(433.92) - 20\log(3/3) = -58.92 dBW \qquad \text{Equation 1.1}$$

Interestingly, SAVI calculated –58.17 dBW using the same formula. For a field of 110,000 microvolts/meter, the result is –58.17 dBm if the frequency is 398.1 MHz – a frequency much preferred by ARRL over the proposed 425-435 MHz.

Savi Data are Not Self Consistent:

SAVI's analysis is not self-consistent. Although SAVI and ARRL reach the same approximate conclusion about the amount of power that will be received by an isotropic antenna located at a point where the peak field strength is 110,000 microvolts/meter, SAVI has miscalculated the free-space field that will be present 100 meters from a source that is producing a field strength of 110,000 microvolts/meter 3 meters from that source.

Using Equation 1.0 on 433.92 MHz, ARRL calculates that –89.38 dBW will be produced in an isotropic antenna located 100 meters away from a source that is producing 110,000 microvolts/meter 3 meters distant from that source.

$$P_{dBW} = -107 + 20\log(110{,}000) - 20\log(433.92) - 20\log(100/3) = -89.38 dBW \qquad \text{Equation 1.2}$$

At 1000 meters, the same formula calculates that –109.38 dBW will be produced.

Table 1 ARRL and Savi Calculations Compared

Distance from source	ARRL calculation for power	Savi calculation for power (interrogator)	Notes
3 meters	-58.92 dBW	-58.17 dBW	ARRL and Savi in agreement
100 meters	-89.38 dBW	-122.57 dBW	-20*log(100/3) = -30.46 dB from the field present at 3 meters. Savi data would

			require that the field vary as -43*log(100/3)
1000 meters	-109.38 dBW	-142.57 dBW	

ARRL's curves show data plotted at points from 1 meter to 1000 meters from a source that is radiating an RF signal that would result in a field of 110,000 microvolts/meter 3 meters distance from that radiating source (plane-wave fields assumed). Although it may not be visually evident from the graph, the curve for a 0 dBi gain receive antenna shows the field at 3 meters distance as –58 dBW . This is in reasonable agreement with the figure that SAVI cited for the interrogator, which generates a field of 110,000 microvolts/meter at 3 meters.

The levels SAVI provided for 1000 meters distance, although incorrect because of this initial error, are 20 dB less than the numbers at a distance of 100 meters distance, indicating that they believe that the field follows a 20log(distance ratio) function. Of note, the test data included with their application for Certification of a series 400 RFID device has a section that discusses how the field varies as 20 log(D/reference distance). SAVI cannot allege (1) that the field varies as –43 log(100/3) between 3 and 100 meters, and (2) that the field varies as –20 log(1000/100) between 100 and 1000 meters.

For reference, here are the graphical data from the 0 dBi (isotropic) antenna from Figure 1 of ARRL's Ex Parte presentation of January 14, 2002.

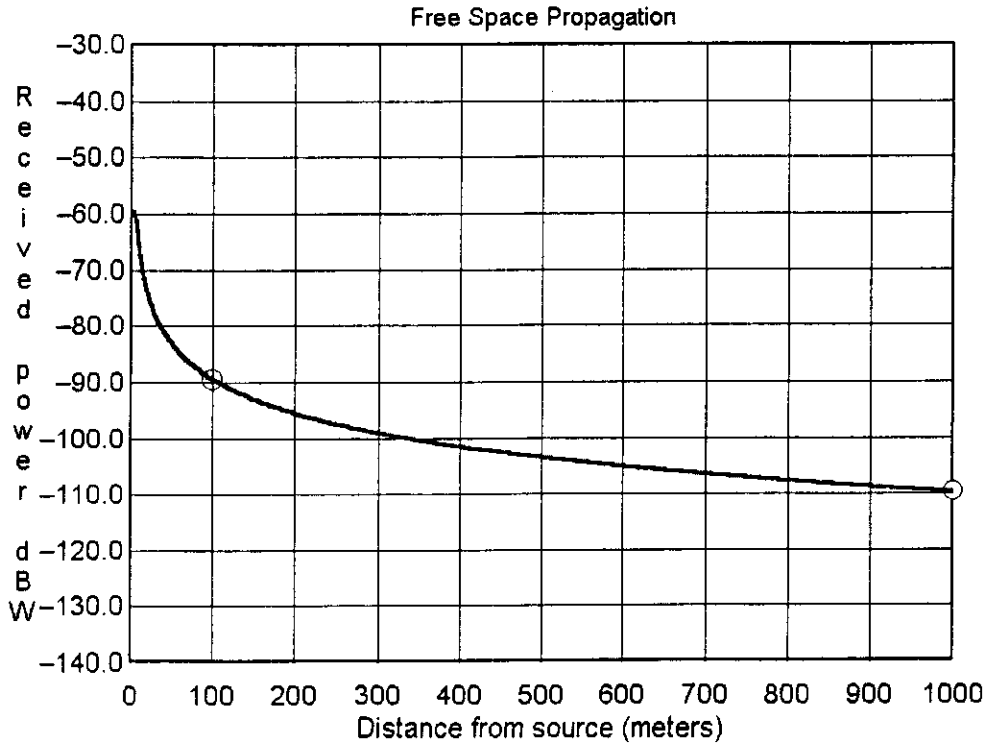

Figure 1. This is the 0 dBi data from Figure 1 in ARRL's Ex Parte presentation. It shows the amount of power that will be received by an isotropic antenna located the specified distances from 3 to 1000 meters from a source that is producing 110,000 microvolts/meter peak at a point 3 meters from that source. The

circles represent ARRL calculations for 100 and 1000 meters from the radiating source. This follows a 20 log(distance ratio) function.

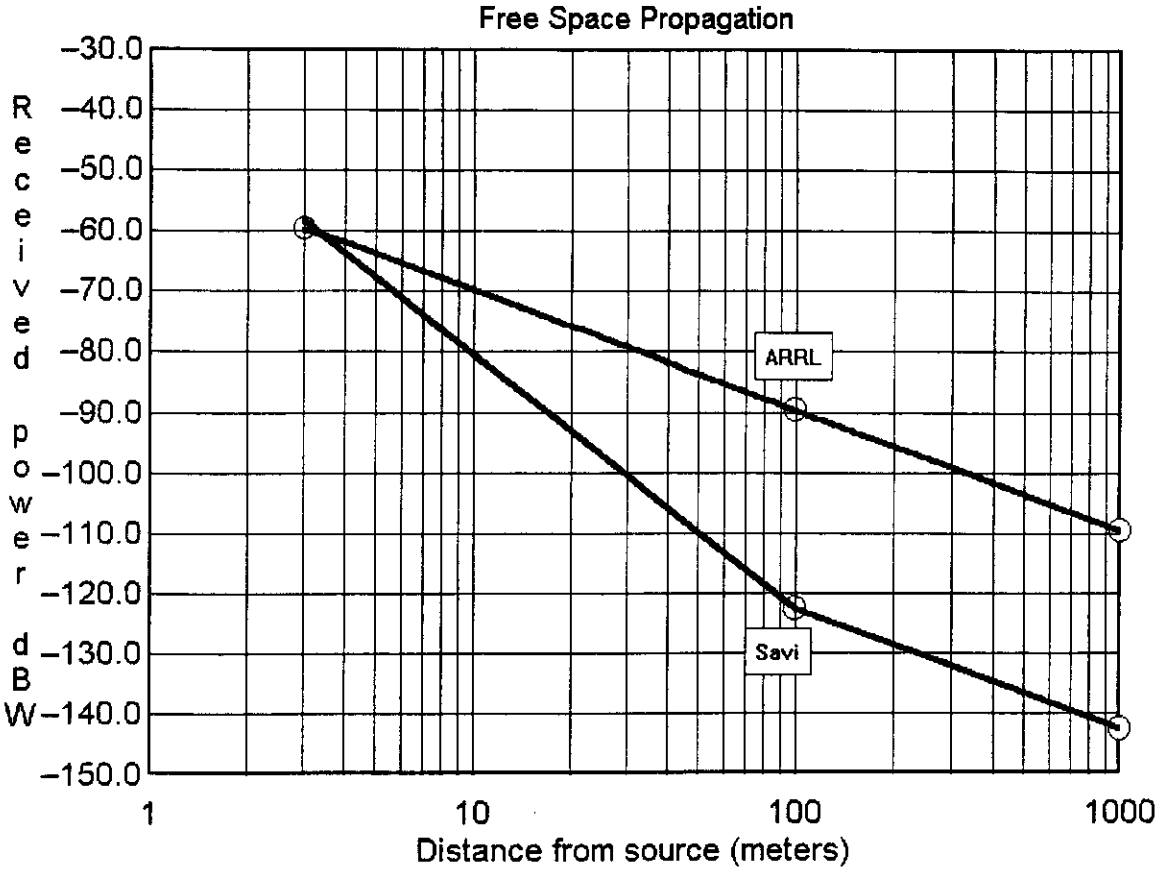

Figure 2. The ARRL data from Figure 1, redrawn onto a logarithmic graph to better show the function of how power density varies in free space. SAVI's calculations for 3 meters, 100 meters and 1000 meters are shown for comparison. The graph shows the amount of power received by an isotropic antenna located at distances from 3 to 1000 meters from a source that is radiating at SAVI's proposed peak power levels. The ARRL data follow a 20 log(distance ratio) function.

Conclusion:

Throughout the course of this proceeding, SAVI has claimed that the signal levels from a near-continuous transmission of 110,000 microvolts/meter (peak) will not cause harmful interference to Amateur Radio communications. However, SAVI's technical analysis is flawed, thus invalidating their conclusion regarding interference potential.

ARRL Spectral Mask Graphs:

In carefully reviewing ARRL's Ex Parte presentation, ARRL noted that some of the graphs did contain an error smaller than the 30 dB SAVI had claimed for the Figure 1 and Figure 2 graphs showing expected received power versus distance. The received-power-versus-distance graphs were correct, but ARRL has supplied separately a corrected version of the Ex Parte summary, with the corrections.